ART. XVII.—*The Medical and Surgical History of the War of the Rebellion.* (1861–65.) Prepared in accordance with Acts of Congress, under the direction of Surgeon-General JOSEPH K. BARNES, United States Army. [Part I., Volume II., Surgical History. By GEORGE A. OTIS, Assistant Surgeon, United States Army.] Royal quarto, pp. clvi., 650, xiv. Washington: Government Printing Office, 1870.

THIS magnificent volume, though bearing the date of three years since, contains, especially in its later portions, a great deal of information belonging to a more recent period; so that it might fairly have borne on its title-page the date of the present year, without its writer incurring any risk either of his work being thought antiquated, or of himself not being considered fully informed as to the surgical questions of the day. After a few pages of prefatory matter, signed by Surgeon General Barnes, Dr. Otis takes up the pen and presents himself to us as the author—or, as he modestly prefers to call himself, the reporter or compiler—of the more than eight hundred large and closely printed pages which constitute the bulk of the volume. To these pages criticism (in the ordinary sense of the word) is hardly applicable—for who can criticize facts?—and it is with facts that Dr. Otis mainly deals; he has, indeed, added comments and deduced conclusions, which approve him both the learned scholar and the judicious, practical surgeon, but his comments are so just and reasonable, and his deductions so fully sustained by the facts from which they flow, that the doubter can but give assent, and the critic waive cavil and join in hearty admiration of the great work accomplished. Hence, in the space allotted to this review, we shall confine ourselves principally to analysis and quotation, aiming to give those of our readers who may not be so fortunate as to have access to the book itself, a fair notion of the immense amount of labour which Dr. Otis has gone through, and of the rich gain to surgical science, which has been thus, through his instrumentality, acquired.

In his introduction Dr. Otis refers to the plan on which it was at first intended that the Medical and Surgical History of the War should be written, and gives the reasons which forced the abandonment of the original design, and led to the adoption of the system which has been actually pursued in the preparation of the present volume; he also gives copies of the various forms of blank return which were furnished to medical officers in the field and in hospitals, in order to secure full and accurate accounts of cases; describes the system of recording employed in the medical department of the Confederate Army—judicious use has been made of such Confederate records as came into the possession of the government during the war or at its termination—and adds that frequent reference has been made to the published reports of the various modern European wars which have occurred before or since our own.

In arranging the material with which he has had to deal, Dr. Otis has proceeded from particulars to generals, beginning with an account of special wounds and injuries, and reserving, for another volume, remarks upon the relative frequency of wounds according to regions, and upon the influence of climate and other hygienic conditions on the results of wounds, with such other general observations as may arise from a consideration of the whole subject. In the present volume is given a chronological summary of the very numerous battles and minor engagements which took place during the four years, from April, 1861, to April, 1865, with the number of killed, wounded, and missing on either side, and the surgical history proper is then begun and continued through five chapters, the first being devoted to wounds and injuries of the head, the second to those of the face, the third to those of the neck, the fourth to those in which injury of the spine was the most prominent lesion, and the fifth to wounds and other injuries of the chest. The various operations which have been resorted to are considered in connection with the injuries of the several regions of the body, a plan which, as the author justly remarks, though more difficult than a distinct classification, offers many advantages in the avoidance of repetitions, and in enabling the writer to present each subject as a whole. In the second volume, which, we are glad to learn, is nearly ready for the press, Dr. Otis will take up the study of the wounds and injuries of the abdomen, pelvis, and genito-urinary organs, and of the upper and lower extremities, with the subjects of amputation and excision; and in the third volume, the consideration of gunshot wounds in general, their graver complications, pyæmia, gangrene, tetanus, and secondary hemorrhage, together with those subjects, not less important to military surgeons if less interesting to their brethren in civil life, the "materia chirurgica," and the transportation and field supplies of the wounded. Some idea of the extent of material with which the author has had to deal, may be obtained from the table on page xxv of the Introduction, from which it appears that, excluding all casualties which terminated fatally on the battle-field, the cases of injury recorded in the Union army from May, 1861, to June, 1865, numbered 408,072, and that 37,531 of these cases ended in death. Referring to the classification adopted in recording the clinical histories of this multitude of cases, Dr. Otis says:—

> "It was simply a nomenclature for a series of blank books, in which surgical facts derived from a variety of sources might be entered for facility of reference, and has been modified as frequently as convenience dictated. It has been found to answer the purpose for which it was intended reasonably well."

In a foot-note consideration is given to Prof. Longmore's criticisms upon this classification (See *Medico-Chirurgical Transactions*, vol. liv. pp. 219 *et seq.*, and *No. of this Journal* for July, 1872, p. 199), and, after showing the gross inaccuracy of Prof. L.'s Arabian-Nights'-Entertainment-like account of the enormous clerical force supposed to be employed in our American Surgeon-General's office,[1] Dr. Otis adds:—

> "I will not complain of the unfairness of contrasting the results of the preliminary report in *Circular* No. 6, with the perfected histories of Dr. Matthew and M. Chenu; but I do complain of an 'American system' being described and unfavourably contrasted with the classification of Inspector-General Taylor, when, as I have shown, there was no complete series of surgical reports in the army of the United States, and information was, of necessity, to be derived from heterogeneous data. 'The surgeons in the field on the American system . . . make no distinction between the various kinds of cranial fractures . . . where all such injuries are tabulated together, as they are in the primary American returns, what useful information can be obtained from a table showing, for example, the results of the operation of

---

[1] Prof. Longmore has evidently been victimized by one of those "perfectly reliable gentlemen" who were in the habit of supplying the American public with startling military news during the late war.

trephining?' ([Longmore, *loc. cit.*] p. 240.) I cordially concur in the warm praise accorded to the histories of the Crimean and Italian campaigns by M. Chenu. I will observe that in his latter work he very materially modifies the classification employed in the former. In the history of the surgery of the Italian war, he reports nine cases of trephining; in his Crimean history Dr. Matthew reports twenty-six cases. I shall record two hundred and twenty cases,[1] and shall be disappointed if their results afford no useful information. Dr. Taylor's classification may be excellent for the British army with its corps of trained medical officers: it could not have been advantageously introduced in our service, chiefly attended by surgeons hastily called from civil life. Dr. Longmore says (p. 235), that in Germany 'no fixed classification exists.' This is quite true, yet the statistical work of General-Artz Dr. Loeffler is a marvel of accuracy and completeness to those who occupy themselves with these studies; and the extended treatises of Drs. H. Fischer, Socin, and Klebs, following so soon upon the conclusion of the Franco-German war, are monuments of well-directed industry. I think that in war 'systems' must be made to conform to the exigencies of the occasion, and to national habits and organizations. There are certain great rules to which all nations will conform; the details must be adapted to varying circumstances. The British system may be best for Britain, but not necessarily for all other countries. On peut être plus sage qu'un gens, mais point que tous les gens."

Dr. Otis concludes his introduction by giving mournfully long lists of the casualties among medical officers during the war: beside all those who perished from disease or exposure, there were no less than nineteen surgeons of the Union army killed in action; thirteen were, while in the discharge of their duty, killed by partisan troops or assassinated by guerillas or rioters; eight died of wounds received in action; nine died from accidents met with in the line of duty; and seventy-three were more or less severely though not fatally wounded in battle.

Turning now to the surgical history itself, we begin our examination of Chapter I., which treats of "WOUNDS AND INJURIES OF THE HEAD," and which, though occupying no less than 320 pages, is even yet not complete, many of the general observations, and notably the discussion as to the applicability of the trephine in military surgery, being reserved for a subsequent volume. Injuries of the head are classified by Dr. Otis in three categories, the *first* embracing incised and punctured wounds, such as sabre-cuts, bayonet-stabs, and sword-thrusts; the *second*, injuries from falls, blows from blunt weapons, and the results of various accidents; and the *third*, gunshot wounds.

Incised and Punctured Wounds.—Brief abstracts are given of the histories of 282 cases of *incised wound of the scalp*, only six cases having terminated fatally, and the injuries received having been the direct cause of death in only three instances. The treatment employed seems to have corresponded pretty closely with that resorted to by civil surgeons, the parts adjoining the wound having been denuded of hair, and the edges then approximated, after the removal of foreign bodies, with strips of adhesive plaster. Sutures were employed in a few instances without ill result, but, as justly remarked by Dr. Otis, though probably less dangerous than has been commonly supposed, they are rarely indispensable. In no case were ligatures employed, compression having been invariably found adequate to control hemorrhage. With regard to the constitutional and hygienic treatment of scalp wounds, Dr. Otis draws a judicious distinction between the depletory and spoliative measures recommended by our ancestors (which he properly repudiates), and the rational and conservative plan of enforcing rest and quietness, and of withholding unsuitable articles of food and drink.

---

[1] Actually, 229 cases.—REVIEWER.

Forty-nine cases are recorded, in which the *skull* was fractured by a sabre or other cutting weapon :—

> "They furnish illustrations of all the varieties of such injuries: the superficial marking of the outer table, the division of the outer table and diploe, the section of both tables and more or less profound penetration of the cranial cavity, and the separation of an osseous flap."

Of the forty-nine cases, thirteen proved fatal, death resulting in ten instances from intracranial inflammation or compression, in one from epilepsy, in one from tetanus, and in one from pyæmia. Removal of fragments was effected in eleven cases, of which only one resulted disastrously—thus confirming the observation long since made by Grima, that the greatest comminution of the skull is often attended with the least injury of the brain. The prognosis in cases of incised fracture appears to vary in a marked manner with the particular part of the skull affected: the statistics here collected corroborate the doctrine of Hennen and Boyer, that sabre-wounds of the top of the head are much less dangerous than those of its lateral portions. Dr. Otis appends to this section a learned and most interesting discussion (which want of space alone prevents our quoting at length) as to the proper treatment to be pursued when parts of the skull are sliced away, and the detached fragments adhere to flaps of integument which have not been completely separated from the rest of the scalp. Authorities seem to be nearly equally divided upon this question, but from a careful examination of the recorded facts, and from mature consideration of the whole subject, Dr. Otis concludes that, although the dangers likely to result, from allowing the flap of bone which adheres to the scalp to remain, have probably been exaggerated, yet that it is, upon the whole, safer to remove the osseous fragment, if it can be readily detached. All portions of the scalp itself should of course be preserved, as its vitality is great and reunion will often occur under what are apparently the most unfavourable circumstances.

The consideration of this part of the subject is concluded by giving a brief record of twenty-eight cases of *incised scalp wound* (one fatal) produced by various weapons other than those legitimately used in warfare.

Punctured wounds of the head are represented by eighteen cases of *punctured scalp wound*, of which two terminated in death, and by six cases of *punctured fracture of the cranium*, of which all but one ended fatally, the survivor in the one favourable case being moreover permanently disabled. These facts aptly illustrate the maxim that in cases of punctured fracture of the skull, the diagnosis is difficult, the prognosis gloomy, and the treatment unsatisfactory. With regard to the latter, Dr. Otis judiciously advises that operative interference should not be resorted to until it is certain that the brain or its membranes are actually implicated.

Miscellaneous Injuries.—In this section are considered those injuries of the head which are met with in military as in civil life, but which are not inflicted by weapons of warfare. A large number of cases are reported of contusion or laceration of the scalp, fracture of the skull, concussion of the brain, etc., produced by railway accidents, by falls, by blows, by kicks from horses, and by other similar causes. Five hundred and eight cases, in all, are recorded in this section; in 331 the soft parts alone were injured, and all of these terminated in recovery; in 72 the brain was injured though the skull was not broken, death ensuing in 14 of these cases, and

53 patients being discharged for disability; while in 105 cases the skull was fractured, and in 57 of these death resulted. The trephine was employed in 18 cases, but in 10 of these unsuccessfully.

The treatment employed in scalp injuries appears to have been generally judicious, though in a few instances effusions of blood were prematurely cut into, with the natural effect of inducing undue inflammation and unhealthy suppuration.

"Concussion of the brain" was observed in a number of instances, and in fourteen cases which terminated in death was the alleged cause of the fatal issue; but none of these cases, says Dr. Otis, "throw any light upon the functional or textural alterations of the brain resulting from this shock, but leave the subject, which has perplexed pathologists for so many centuries, as inscrutable as ever." We must add that none of these cases tend to shake the belief which we have long entertained, that there is no definite pathological condition to which the term "concussion" can with any propriety be applied, and that the term itself should be abandoned except as indicating the cause of what have been described by Hewett and others as "concussion lesions." The total number of cases recorded during the war as concussion of the brain from causes other than gunshot, appears from a table given on page 66 to have been 922, of which number 215 cases terminated fatally.

Of the 105 cases of fractured skull recorded in this section, 46 are known to have been examples of simple, and 43 of compound, fracture. Of the whole number 19 recovered completely, 29 recovered partially, and 57 died; the causes of death were, compression by bone fragments and intracranial hemorrhage, each in 16 cases, encephalitis in 10, abscess of the brain in 6, cerebral laceration in 5, shock and "concussion" in 2, and epilepsy and "hernia cerebri" each in 1. The mortality of fractures at the base of the skull was almost double that of fractures of the vault. There were no instances of fracture limited to the internal table, and but two or three of fracture confined to the external table of the skull. Watery discharges from the ear were observed in two cases. In three, fracture of the base of the skull was supposed to have been caused by *contre-coup*.

> "In 79 cases of fracture of the skull treated without operative interference, the death-rate was 54.4; of 26 cases operated upon, the ultimate results are ascertained in 23, in which the mortality-rate was 60.8."

Gunshot Wounds.—The number of recorded cases of *gunshot wound of the scalp* is so large that Dr. Otis merely gives them in the form of a tabular statement, supplementing the table by brief details of the fatal and complicated cases. The total number is 7739, of which 162 are known to have terminated fatally. In 30 instances death appears to have resulted from encephalitis, although no primary lesion of the skull was observed by the surgeons by whom the patients were treated. The occurrence of erysipelas was noted in only 22 cases, of which 8 proved fatal through the supervention of meningeal inflammation. Gangrene was observed in but 9 cases, of which 4 ended fatally. Primary hemorrhage was very rarely a serious complication, but secondary hemorrhage was more common; 21 cases in all are recorded, of which 2 proved fatal, and in 8 of which it was necessary to resort to ligation of the bleeding vessel. Tetanus was the cause of death in five cases, and in one instance was supposed to have been cured by the inhalation of chloroform; but, as Dr. Otis justly remarks, in this case "the evidence is anything but satisfactory." Pyæmia was observed in five cases (all fatal), and in twelve cases death was attributed to "typhoid fever," a term which Dr. Otis tells us "was often employed in a very loose sense by some of the medical officers [it is, we may add, similarly employed by too many civil surgeons], being applied not infrequently to a state of exhaustion resulting from irritation or traumatic fever." Malarial fever is given as the cause of death in four cases, and pneumonia in thirteen; but Dr. Otis suspects, with great reason, that in some at least of the cases in each category a pyæmic condition was the real cause of the fatal issue. The remaining causes of death were various intercurrent affections, such as smallpox, diarrhœa, diphtheria, etc. The treatment adopted by our surgeons in cases of gunshot scalp wound seems to have been usually simple and judicious, though in some few instances sutures were employed, with what possible object can only be conjectured.

Gunshot contusion of the skull was observed in 328 patients, of whom 55 died, 100 were returned to duty, and 173 were discharged from service; of the latter, 75 may fairly be added to the list of those who recovered. Complications were observed in a number of cases; thus hemorrhage occurred in five instances (two primary, three secondary), in one of which ligation was found necessary, erysipelas in ten cases (one fatal), gangrene in two, and deep burrowing of pus in six cases. Periostitis, following contusion of the cranial bones, occasionally gave rise to caries, and not seldom to necrosis, leading to the exfoliation of more or less considerable portions of the skull in thirty-seven cases, of which five proved fatal. Localized and persistent pain was observed in ten cases, but in none of these was it thought right to resort to operative interference. Dr. Otis has carefully examined more than forty skulls contused by gunshot projectiles, without finding a single example of that local hyperostosis which has been described as a frequent result of this form of violence; in two instances there was abnormal thickening, but in these cases the patients died so soon after the reception of their wounds as to make it probable that the morbid condition was antecedent to, rather than caused by, the injury. The Army Medical Museum, however, contains three specimens of chronic thickening of the cranium resulting from contusions produced by falls or blows.

The causes of death in the fifty-five fatal cases of gunshot contusion, were external hemorrhage in two, tetanus, pyæmia, typhoid fever, and dysentery, each in one; cerebral compression from intracranial hemorrhage or suppuration in seventeen; and meningitis or other secondary lesions of the encephalon in thirty-two. Among the patients who survived, various nervous affections were observed, such as vertigo, epilepsy, paralysis, aphasia, and impairment of the special senses or mental faculties.

> "Of sixteen cases of operative interference, four only had a favourable termination, and these were examples of the secondary removal of exfoliated fragments, Art serving as the handmaid of Nature, who had already nearly effected a cure. In the twelve remaining fatal cases, in which formal trephining was resorted to, pus was found between the skull and dura mater in four instances, beneath the dura mater in one case, and in the substance of the brain in one. In two instances it is alleged that intracranial extravasation was observed; in another that arachnitis was present; in three cases the causes of the symptoms of compression were not specified. . . . The patients survived the operations on an average about three days."

Gunshot fracture of the external table of the skull, without injury to the internal table, has been reported as having occurred in a number of cases; but, excepting fractures of the outer wall of the frontal sinus, or of the mastoid and zygomatic processes of the temporal bone, and instances of grooving of the outer table of the cranial vault by fragments of shell, there are no specimens in the Army Medical Museum which furnish satisfactory examples of this form of injury. The whole number of cases of fracture of the external table reported is 138, and 12 of these proved fatal, though in only 10 instances was death attributable to the injury received. After a careful examination of the facts in each case, Dr. Otis is disinclined to admit that (with such exceptions as have already been indicated) "the outer table of the skull is ever fractured in the adult without injury to the inner table, either by projectiles of war or any other external violence." We are disposed to think that the addition of the last five words makes this rule too absolute, and indeed we observe that, in a previous part of the volume, Dr. Otis has himself admitted as genuine, reported cases of fracture of the external table of the parietal bone, the result of blows from sabres.

Twenty cases are recorded of *gunshot fracture of the internal table of the skull* without fracture or depression of the outer table. Of these, all but one (Dr. Bellows's case) proved fatal, the diagnosis in that instance having been verified by the exfoliation of a sequestrum involving the whole thickness of the skull, and showing that, while the external table had escaped injury, the internal was the seat of a depressed fracture. Dr. Otis introduces in this section a most learned and interesting disquisition, in which he reviews in an exhaustive manner the literature of this rare form of injury, and ably discusses the mechanism of its production, giving due credit to Teevan, of London, for having by experimental inquiry first demonstrated the true mode in which this form of fracture occurs. The diagnosis of fracture of the inner table of the skull must always be difficult during the life of the patient, though Stromeyer, following Lanfrancus, Paré, La Motte, and Atthalen, believes that the lesion may sometimes be recognized by percussion, the resonance at the seat of fracture being of elevated pitch and somewhat resembling the "cracked-pot sound" observed in certain affections of the chest. This difficulty of diagnosis Stromeyer considers "lucky for the patient, because thereby he escapes the danger of being trepanned." Dr. Otis, on the other hand, thinks the use of the trephine "undeniably justifiable" in the event of the persistence of urgent symptoms of compression, and particularly if there is paralysis of the side opposite to that of the injury. It is to be remembered, however, that while, as Dr. Otis justly remarks, "it cannot be doubted that many cases of this form of injury terminate favourably and are never recognized," eight out of twelve (misprinted in the text as eleven) cases here reported or referred to, in which trephining was practised, proved fatal, while the only patient who is positively known to have recovered from this injury during our war was not trephined. Hence, in view of the difficulty of diagnosis, and of the impossibility in most instances of determining to what condition the symptoms of compression and paralysis are actually due, the number of cases in which operative interference would be justifiable must, it seems to us, be extremely limited.

So many cases of *gunshot fracture of both tables of the skull* were reported during the war, that Dr. Otis has found it practicable to give abstracts of only the more interesting examples of each variety, with brief notes of others, and tabular statements of the whole number recorded. Of *linear or capillary fissure* there were reported nineteen cases, of which twelve ended favourably, while seven terminated in death. Dr. Otis, however, has not been able to satisfy himself of the correctness of the diagnosis in any of these cases, and suspects that in each there was more or less injury of the cranial contents, with depression of the inner table, a condition which was actually found to exist in those of the fatal cases in which autopsies were made. In many instances both tables of the skull were broken *without there being any depression of fragments;* in some cases, by the oblique impact of balls or pieces of shell, considerable portions of bone were detached; in other cases bits of lead were clipped off from glancing balls and embedded; while in other cases, again, larger portions, or even entire balls, lodged in the diploe, or in the frontal or mastoid sinuses.

Gunshot depressed fractures of the skull were very numerous, and presented examples of every variety of the injury which has been described by military surgeons. Thus there were fissures of the external with extensive splintering of the internal table, punctured fractures, depressed fractures with long fissures radiating in various directions, etc. In many cases balls were split upon the cranial bones, the missiles sometimes remaining astride of a sharp edge of bone, and at other times separating into halves, one of which penetrated the cranium while the other flew off or perhaps lodged beneath the integument or aponeuroses. Caries or necrosis, exfoliation of sequestra, paralysis, epilepsy, loss of sight, of hearing, or of taste, and various other nervous affections, were among the sequelæ observed in these cases.

Penetrating gunshot fractures of the skull were of frequent occurrence. In many instances balls lodged within the cranial cavity, and in a number of cases attempts at extraction were made, usually without avail, but occasionally with gratifying success. *Perforating gunshot fractures of the skull* were also often observed, and in fourteen cases the patients survived, though totally and permanently disabled. *Crash or smash* is the expressive title given by Dr. Otis to those cases of depressed fracture of the skull which were produced by the impact of cannon balls, or by the explosion of large shells, and which were commonly attended with great comminution and disjunction of the sutures, invariably proving fatal, if not immediately, at least within a very few days. Not many cases of this nature are related, as from their speedy termination they present comparatively few points of surgical interest.

Numerous cases are recorded in which, without formally resorting to the operation of trephining, *fragments of bone were removed* after gunshot fracture of the skull. In a good many instances more or less complete recovery was thus secured, but in other cases the patients, though surviving, became epileptic or insane, or suffered from various nervous affections, such as partial paralysis, headache, want of co-ordinating power over the muscles, or impairment of one or more of the special senses. Erysipelas (as in all cases of head injury during the war) was comparatively seldom met with, as were gangrene and pyæmia, though each of the latter led to a fatal result in several instances. Beside the causes of death just mentioned the chief sources of mortality in the fatal cases were intracranial or external hemorrhage, meningitis, cerebritis, and intracranial suppuration.

The question of the value of *trephining*, in cases of gunshot injury of the head, is justly considered by Dr. Otis so important, that he has taken pains to record all the facts relating to the subject that have been reported, and to detail all the accounts of formal operations of the kind performed during the war, which he has been able to collect. Beside the cases which have already been considered (of trephining for contusion of the skull, etc.), there are here given 95 cases of trephining for gunshot fracture, which proved fatal; 24 which resulted in recovery with various degrees of disability; 15 in which the patients recovered sufficiently to resume their military duties; 4 in which the patients were placed on modified duty in the Veteran Reserve Corps; 6 in which the patients were exchanged, paroled, or furloughed, and 36 cases in which the patients were discharged from service. As we have already mentioned, Dr. Otis has not yet published his own conclusions as to the applicability of the trephine in military surgery, and comments on the facts which he has detailed would therefore be at the present time premature.

Hernia cerebri was reported as existing in a number of cases, of which 51 are here given in detail; but 8 of the 44 which proved fatal are considered by Dr. Otis to have been simply examples of primary protrusion of brain matter from extensive gunshot fractures, and only 36 to have been illustrations of what is properly described as fungus or hernia cerebri. In 4 of the 51 cases trephining was resorted to, and projectiles were extracted in an equal number; in 25 cases, without formal trephining, fragments of bone were removed. From page 318 we learn that the whole number of cases of hernia cerebri was 61, of which only 11 terminated in recovery.

Fracture by contre-coup is the subject of several interesting paragraphs in which Dr. Otis analyzes the various cases occurring during the war, which were supposed to be examples of this kind of injury. This portion of the volume possesses a melancholy interest for all citizens of the United States, for in the case given on page 305, every reader will at once recognize that of our murdered President, the lamented Lincoln. We would direct Dr. Otis's attention to what is obviously a misprint in the account of the symptoms: "Over the *left* eyelid," it is said, "there was slight ecchymosis. The pupil of *that* eye was slightly dilated, the *left* pupil was contracted; both were irresponsive to light." The importance of this case from a historical point of view is so great, that we hope the ambiguity in the sentences quoted will be removed by a note in the next volume of the history. The most remarkable pathological feature of President Lincoln's case was the fact that both orbital plates of the frontal bone were fractured, the fragments being pushed *upwards* towards the brain, while the ball, which had entered through the occipital bone, was found lodged in the brain above but not in contact with the broken orbital plates. The latter were regarded as having been fractured by *contre-coup*, but Dr. Otis, adopting the suggestion of Prof. Longmore, considers it a more plausible explanation, that the force of the ball's impulse was transmitted directly through the cerebral mass itself, and accounts for the peculiar displacement of the orbital plates by supposing that they were pushed upwards by the pressure of the blood extravasated within the orbits. With due diffidence we must confess that we are not satisfied as to the correctness of this theory, and venture to express the opinion that the true explanation of the lesion in question is somewhat different. With regard to the subject of *contre-coup*, it has always seemed to us that a great deal of unnecessary confusion is created by the want of agreement among surgical writers, as to precisely what is to be understood by the term; if the word is to be used in its most limited sense, as applying solely to an isolated fracture, caused by violence applied to a part diametrically opposite to the point of injury, probably the orbital fracture in President's Lincoln's case may not, as Prof. Longmore remarks, be regarded as a fracture by counter-stroke; but, on the other hand, if the word is to be used in a broader sense,[1] as applying to an isolated[2] fracture caused by transmitted or indirect violence, the lesion being at a distance from the point at which the injury is received, then President Lincoln's case affords as fair an example of fracture by *contre-coup* as can be asked for.

The true explanation of this case is, we believe, to be found in a study of the considerations advanced by Saucerote, Sabouraut, Chopart, and Delpech, in their writings on the subject of *contre-coup*, which considerations, though not in fashion with modern pathologists, have always seemed to us eminently reasonable. The theory which was propounded by the writers referred to, is, as is well known, that the skull (like any other spherical or ellipsoidal hollow body) undergoes, when struck, certain changes in shape, the diameter corresponding to the point of impact being first shortened while the transverse diameter is lengthened, and being subsequently lengthened while the transverse diameter is shortened, these alternate oscillations in form continuing until the force of the blow has been exhausted, when the parts return to a state of rest. Now, the first effect of a ball striking the occipital bone (as in President Lincoln's case) would be, according to this theory, to shorten the antero-posterior diameter of the skull, and lengthen the lateral diameters, drawing all parts in front (including the orbital plates) *inwards toward the brain*, and pressing the lateral portions outward. But bearing in mind that in cases of fracture by transmitted violence the weakest parts always give way—the orbital plates in this instance were, according to Dr. Otis, "unusually thin"—and bearing in mind Teevan's rule, that fracture invariably begins in the line of extension, what should we expect but that the weakest parts (the unusually thin orbital plates) should yield, and that they should yield in the line of extension, viz., inwards toward the brain; and this is precisely what was found in President Lincoln's case after death. This explanation (which is merely an application of the old doctrine of *contre-coup*), seems to us, upon the whole, more satisfactory than Dr. Otis's theory of displacement by the pressure of blood extravasated within the orbits. As to the fracturing impulse being transmitted through the cerebral pulp, we confess that it seems to us much more probable that the force should pass around through the walls of the skull itself; the brain mass, measurably approximating in structure to a fluid, would, we should suppose, tend to diffuse force equally in all directions, rather than to transmit it with such concentration as to lead to the occurrence of fracture.

Dr. Otis quotes from Prof. Longmore an account of a somewhat similar case, in which a gunshot fracture of the left *parietal* bone was accompanied by fracture of the left orbital plate, and, we may add, gives on page 49 another analogous instance, in which an isolated fracture of the right orbital plate accompanied fractures of the right *temporal*, *sphenoid*, and *frontal* bones, not due, however, to gunshot injury.

The chapter on head injuries is terminated by a *summary* which includes three tables giving (1) the results of 4350 gunshot injuries of the cranium reported during the war of the Rebellion, (2) the nature and results of 12,980 injuries of the head from all causes as reported during the war, and (3) the results of 911 cases of injury of the skull in which operations were performed. We transcribe the latter table for the benefit of our readers.

---

[1] This is the sense in which the term was used by Grima, Saucerote, Sabouraut, Chopart, David (writing under the name of Bazille), and others of the older writers. (See *Mém. sur les sujets proposées pour les prix de l'Académie Royale de Chirurgie*, t. iv., and David's essay, also translated in *Justamond's Surgical Tracts*, London, 1789, pp. 241–313.)

[2] We say an *isolated* fracture, because the ordinary fractures of the base of the skull have been shown by Aran and Hewett to be invariably accompanied by fissures reaching into the vault, and, therefore (as justly remarked by Saucerote), rather prolonged fractures than fractures by *contre-coup*.

Operations.	Cases.	Recoveries.	Deaths.	Undetermined.	Ratio of mortality.	Remarks.
Extraction of missiles	175	89	83	3	48.3	The missiles extracted from beneath the scalp or soft parts are not reckoned in this table.
Ligations	33	21	12	...	36.3	
Removal of bone splinters or elevation of depressed bone .	454	275	176	3	39.0	
Formal trepanning[1]	220	95	124	1	56.6	
Operations for hernia cerebri .	29	7	22	...	75.8	

Of 2911 cases of fracture of the skull without known depression, 1085 terminated in recovery, operations of one kind or another having been performed in 262 instances, and non-operative treatment having been employed in the remaining 823. From the reports of the pension office, the subsequent condition of a number of the survivors has been ascertained, and, as might be expected, in many instances the pensioners suffer from persistent headache, vertigo, or other nervous manifestations.

As may be seen from the preceding table, *ligations of arteries* were practised in 33 cases of injury of the skull. The *common carotid* was tied in seven instances, four times on the left side (with one death), and three times on the right side, all of these cases proving fatal. The same vessel was tied 54 times in cases of face wound, and 23 times in cases of wound of the neck or spine, giving a total of 84 examples of this operation, with 63 deaths, or a mortality of 75 (misprinted as 76.8) per cent. The other instances of ligation in cases of head injury, which call for notice, are one of the external carotid (unsuccessful), and twenty-two of the superficial temporal, of which five proved fatal—two of the latter from hemorrhage.

In 186 cases, *balls penetrated the cranial cavity;* in 85 instances the foreign body was removed, with 43 recoveries and 42 deaths, while in 101 cases the foreign body was not removed, only 42 of these ending in recovery, while 59 proved fatal. These figures, however, must not be taken to justify reckless hunting after balls lodged in the brain; for it is quite possible that some cases which ended in death after unsuccessful efforts had been made to extract the foreign body, might have terminated differently had no interference whatever been attempted; we believe that Brodie's rule upon this subject is a sound one, that it is better even to allow a foreign body to remain, than to increase the irritation of the brain by injudicious efforts at removal.

Beside the 220 cases of *trephining* included in the table which we have quoted, Dr. Otis has collected, since that table was printed, nine others, of which six ended in recovery and two in death, the ultimate result of one not having been ascertained; the death-rate of terminated cases is thus reduced to 55.5 per cent. The dates of operation are known in 162 cases of trephining for the results of gunshot injury; 46 were cases of primary operation, with 32 deaths (69.6 per cent.), 99 of intermediary operation, with 56 deaths (56.6 per cent.), and 17 of secondary operation, with 4 deaths (23.5 per cent.). It thus appears that in trephining, unlike amputation and excision, the chances of recovery are better (other things being equal) the longer the operation is postponed; a strong argument, it seems to us, against the use of the trephine as a prophylactic against complications which may perhaps never arise. Dr. Otis corrects, in a foot-note, a statement which was made in the well-known Circular No. 6, to the effect that

---

[1] Nine additional cases are afterwards reported.—REVIEWER.

> "'Surgeon D. W. Bliss, U. S. V., alone has reported eleven successes after the use of the elevator, or trephine.' It is true," adds Dr. Otis, "that Dr. Bliss has reported eleven cases, but I find on examining them that his success, though gratifying, was not uniform. Doubtless his success was overestimated, as, subsequently, in regard to the efficacy of cundurango in cancer, from reporting cases before the cures were confirmed. He had eleven cases of trephining, with six recoveries, ... besides four cases of removal of fragments, ... or fifteen cases, with eight recoveries."

In thus terminating our examination of Chapter I., we feel that we in no degree overestimate its value when we pronounce it the most valuable single contribution which has ever been made to the subject of Injuries of the Head.

Chapter II. is devoted to a consideration of "WOUNDS AND INJURIES OF THE FACE," and, like its predecessor, is divided into three sections, treating respectively of (1) incised, punctured, lacerated, and miscellaneous wounds; (2) gunshot wounds; and (3) plastic operations for deformities resulting from wounds and injuries of the face.

Incised Wounds, Contusions, and Miscellaneous Injuries.—Several hundred cases are grouped under this heading, but only a few are considered of sufficient interest to be separately recorded. The most serious cases belonging to this class were those of burn or scald, which are, however, reserved for future consideration. *Sword wounds* of the face were met with in 37 cases; 28 patients returned to duty, three were discharged, one was exchanged, one deserted, one died, and three are not accounted for. *Bayonet wounds* were observed in 27 instances; 11 patients returned to duty, 11 were discharged, one died, and four are not accounted for. *Fractures of the bones of the face* were observed in 64 cases, of which three proved fatal, as did likewise three out of 271 cases of wounds or contusions of various kinds which are classed together as *miscellaneous injuries.*

Gunshot Wounds.—Gunshot injuries of the face, though of a serious nature on account of the great deformity to which they often give rise, are not attended with a very high rate of mortality. Dr. Otis has classified the cases recorded during the war, according to the part affected, and considers first *gunshot wounds of the orbital region.* In 63 cases the sight of both eyes was destroyed by gunshot injury, and 17 of these cases terminated fatally; in 825 cases the sight of one eye was destroyed, and in 47 of these death resulted from implication of the brain or large vessels. In 91 instances in which one eye was destroyed, the sight of the remaining became sympathetically affected. The total number of cases of gunshot wound of the eye recorded (excluding cases of powder burn, etc.), was 1190, of which 64 terminated in death; 379 patients recovered sufficiently to return to duty, and 679 were discharged, while the ultimate result in the remaining 68 cases has not been ascertained.

> "The percentage of recovery, where a single eye was torn from its socket by a bullet, was large, and the secondary lesions of the brain or of the opposite

eye were less frequent, after this rude mode of extirpation, than in cases in which buckshot or small pistol-balls lodged within the globe."

As may be supposed, the eyelids rarely escaped injury when the eye was wounded, and entropion or ectropion, anchyloblepharon, and symblepharon, were frequent sequelæ in this class of cases. The eye was seldom destroyed without the orbital walls being injured, but unless the fractures in such cases extended to the cranial cavity, the results were seldom fatal.

"There was no carefully reported case of amaurosis induced by the divison of the supra-orbital nerve by balls, and nothing in the reports to sanction the assertion of Mackenzie that the 'wind of a ball has been known to produce amaurosis.' The 'wind of balls,'" pointedly adds Dr. Otis, "has long been wafted out of the domain of military surgery."

Traumatic cataract not unfrequently followed gunshot contusion of the eye.

From a general survey of all the cases reported during the war, Dr. Otis justly concludes that, whenever foreign bodies are lodged in the globe of the eye, they should be extracted at all hazards, and that, if extraction cannot be accomplished, the globe itself should be extirpated in order to preserve the other eye. When panophthalmitis follows a gunshot injury, a free transverse incision should be made to evacuate the contents of the eyeball.

This section is terminated with abstracts of 138 cases of *gunshot fracture of the facial bones*, 57 of these cases having terminated fatally. Secondary hemorrhage supervened in 76 instances, and the common carotid artery was tied 13 times with five recoveries.

Plastic Operations.—In this section are given the histories of thirty cases in which plastic operations of greater or less magnitude were performed by Drs. J. C. McKee, U. S. A.; Buck, Sands, and Gouley, of New York; Keen, Judson, and Grove, of this city; the late G. C. Blackman, of Cincinnati; Culbertson, of Zanesville, Ohio; the late C. B. Gibson, of Richmond, Va., and other surgeons. Many of these cases are of much intrinsic interest, and all are deserving of study by those who pay special attention to plastic surgery; but the space already occupied by this review and the amount of material yet to be considered, warn us to pass on to other subjects.

This chapter concludes with a *summary*, giving tables of (1) 3312 cases of gunshot fracture of the facial bones,[1] of which 340 proved fatal; (2) 4914 cases of gunshot wound of the face, without known fracture, of which only 58 proved fatal; (3) 9815 cases of injury of the face from all causes, of which 470 proved fatal; and (4) 671 cases in which operations were performed, of which 80 proved fatal.

Wounds of the ear were seldom of sufficient importance to be regarded as worthy of detailed record; in seven instances the auricle was completely carried away by large projectiles, and in two cases great mutilation was produced by musket-balls, but in none of the nine cases does there appear to have been any impairment of the power of hearing. *Wounds of the nose* were of importance, chiefly from the disfiguring deformity to which they were apt to give rise—the contraction of the nostrils and depression of the nasal bridge, bearing sometimes, as pointed out by Dr. Otis, an unpleasant resemblance to the results of constitutional syphilis. In addition to the cases of eye injury previously reported, Dr. O. gives on page 386 a curious case of *bayonet wound of the eye* which came under his own observation. *Wounds of the cheek* usually healed without difficulty except when the parotid duct was involved, in which case a salivary fistula often persisted and required operative interference. Local palsies, neuralgias, or spasmodic twitchings, often followed injuries of the portio dura, or of the branches of the fifth nerve. With regard to the attempt to procure primary union in cases of gunshot wound of the face, by paring the edges of the wound and bringing the parts together with sutures, as advised by Larrey (a plan which was favourably reported on by Chisolm and Michel, of the Confederate army), Dr. Otis declares that the evidence adduced to prove the efficacy of the method is inconclusive, and agrees with Légouest that such a proceeding, while unnecessary in the slighter cases, is attended with positive disadvantages in those which are of a graver character.

---

[1] The lower jaw was involved in more than one-half, and the upper jaw in nearly one-fourth of the whole number of cases.

Wounds of the upper jaw were usually found to be serious injuries, those patients who escaped the risks of hemorrhage being often called upon to experience such complications as erysipelas or pyæmia, or suffering impaired health from prolonged suppuration and the unavoidable swallowing of decomposed secretions. Here, as elsewhere in the volume before us, Dr. Otis inveighs strongly (but, in our judgment, none too strongly) against the use, in the treatment of hemorrhage, of those abominable preparations known as Monsel's salt and Monsel's solution. Had Dr. Hammond included these vile compounds among the articles prohibited in his famous calomel and tartar-emetic order, he would, we doubt not, have saved many lives, and would thereby have deserved well of posterity.

Wounds of the lower jaw were met with three times as often as those of the upper maxilla, the mortality rate being about the same (8.3–8.1) in both cases. Very varied modes of treatment were employed, but, upon the whole, none seem to have been more satisfactory than the use of a simple pasteboard splint with oakum pad and bandage.

As already indicated, *hemorrhage*, and particularly secondary bleeding, was a common and very grave complication of wounds of the face; the whole number of cases in which the common carotid artery was tied for hemorrhage under these circumstances, was, as already mentioned, 54, and in 38 of these death is known to have resulted. In one case (of fractured lower jaw), the internal jugular vein was accidentally wounded in extracting a ball which had lodged in the neck, but, double ligatures being promptly applied, the patient recovered without any evil consequences ensuing.

In several cases considerable portions of the upper or lower jaw were successfully excised, and in a few instances it was thought advisable to resort to the operation of staphyloraphy.

Chapter III. is devoted to the study of "WOUNDS AND INJURIES OF THE NECK," of which about 5000 cases were reported during the war, exclusive of cases complicated by lesions of the face, chest, cervical spine, or great vessels—which are considered elsewhere. The chapter is divided into three sections, (1) on miscellaneous injuries, (2) on gunshot wounds, and (3) on operations.

Incised and Punctured Wounds and Miscellaneous Injuries.—In this section several instances of sabre or bayonet wound are recorded, with two remarkable cases, one of cut-throat and one of fracture of the hyoid bone; the latter possesses a certain historical interest as that of the infamous jailor Wirz. The case of cut-throat was one involving the larynx and œsophagus, and was chiefly remarkable on account of the means adopted by the patient (who obstinately refused nourishment) to assuage his thirst:—

> "From a pail of water, placed above the level of his head, he could suck through a rubber tube, by bending forward and closing the wound, a little water that was apparently swallowed; then using the tube as a syphon, he would let the water pass through the pharynx and escape through the wound. He required eight pailfuls, or twenty gallons, of water daily."

Gunshot Wounds.—This section embraces many cases of great interest; in 136 instances, *missiles lodged* in the neck, extraction being effected in 87 cases, while in others the foreign bodies became encysted, or, more rarely, gravitated through the surrounding tissues, and thus made their way into the nearest cavity, or were spontaneously eliminated from the exterior surface. Dr. Otis narrates a curious case which came under his own observation, in which an inch and a quarter grapeshot, fired from a battery about three hundred yards distant, struck the hyoid bone, and being deflected from its course buried itself in the muscle of the right scapular region, whence it was removed; the patient did well for four days, and then died rather suddenly from œdema of the glottis.

Torticollis was observed in a large number of cases, as the result of wound of the sterno-cleido-mastoid muscle, and, as shown by the reports of pension surgeons, has been often very persistent. Stromeyer's opinion is, however, quoted, to the effect that, when the muscles alone are involved, complete recovery may ultimately be expected.

Wounds of the larynx or trachea were observed in more than 80 cases, and in many instances were followed by loss of voice, exfoliation of cartilage, and the persistence of aërial fistulæ. An interesting case is given from the records of the Confederate army, which shows that the zeal without knowledge of volunteer assistants produced as baleful effects among the Southern wounded as among our own. The victim in this instance was a corporal of a Virginia regiment, who was shot through the trachea at Spottsylvania on May 10, 1864. He was received into a Richmond hospital, and was rapidly improving, when, on the tenth day—

> "Some intermeddling woman going through the hospital, thinking she would benefit the patient by renewing the dressing, and without consulting the surgeon in charge of the ward, removed the dressing, and plugged the wound with cotton saturated with turpentine. The patient, not being able to speak, was compelled to submit to this cruel treatment, which caused his death . . . before the woman who did the mischief left his bedside."

Wounds limited to the *pharynx or œsophagus* were not very common, though these organs were implicated in many cases which proved immediately fatal from concomitant injuries of the great vessels or nerves of the neck.

Among the secondary consequences and complications of gunshot wounds of the neck, the most important were paralysis, hemorrhage, erysipelas, gangrene, and pyæmia.

Operations on the neck.—A tabular statement of the more important operations performed for gunshot wounds or other surgical affections of the neck, shows that there were 29 ligations of vessels with 22 deaths, 14 tracheotomies with 8 deaths, 6 laryngotomies with 5 deaths, 2 excisions of tonsils with no deaths, and 87 extractions of balls with 12 deaths. *Tracheotomy* was performed six times for gunshot wound, with four deaths and two recoveries. The same operation was performed twice, and *laryngotomy* four times, for œdema of the glottis, but only one of the six cases proved successful. Three operations were performed for diphtheria, one (laryngotomy) terminating in recovery, but both the others (tracheotomy) proving fatal. Tracheotomy was performed twice, successfully, for simple laryngitis, and twice—once successfully and once without success—for apnœa resulting from quinsy, as was laryngotomy once, likewise without success. *Ligation of the common carotid artery* was performed 21 times, but only once successfully, and ligation of the third part of the *subclavian* once, with a fatal result; reference is made (page 422) to a successful ligation of the *internal jugular vein*, but the history of the case seems to have been by some oversight misplaced, and one of another character substituted. Dr. Otis, in connection with this subject, speaks with deserved praise of Dr. S. W. Gross's excellent papers on wounds of the internal jugular vein, published in the numbers of this Journal for January and April, 1867; Dr. O.'s own remarks upon this subject are reserved for a separate chapter on Venous and Arterial Hemorrhages. With regard to ligation of the carotid in cases of gunshot wound of the face or neck, Dr. Otis, after pointing out that the mortality of terminated cases during the war was 78 per cent., adds:—

> "The exhibit is yet more deplorable than that of the preliminary report in *Circular* 6, S. G. O. 1865, which gave for forty-nine cases a fatality of 75 per cent., and will furnish M. Léon Lefort . . . an additional argument against the performance of this operation for traumatic causes, unless the injury involve the main trunk itself, and a ligature can be placed above and below the point of injury. Nowhere else, not even in wounds of the forearm or legs in which the brachial or femoral may have been tied, does the operation of Anel appear to greater disadvantage. Tying the common trunk for injuries of the smaller vessels of the head or neck is an operation based on a fallacious interpretation of the anatomical and physiological relations of the region. Nothing that is not corroborative of Guthrie's admirable suggestions is found in the preceding cases. If the indolent or timid surgeon, who, to control bleeding from minor branches of the carotid, prefers to stuff the wound with styptics, or to perform the easy operation of tying the common trunk, rather than to seek in the difficult anatomy of the maxillary and thyroid regions, to place double ligatures at the bleeding point, he may temporize, or may associate his name with the necrology of ligations; but if his patient recover, it will generally be found to be under circumstances in which the surgeon's operative intervention was uncalled for."

This chapter is terminated with an account of two cases of gunshot wound of the neck, in which paralysis was relieved by the removal of balls—in one instance nearly a year, and in the other nearly seven years after the date at which the injury was received. The operator in the first case was Dr. R. Fraser Michel, and in the second Dr. N. S. Lincoln. Due praise is given here, as elsewhere in the volume, to the careful investigations of Drs. Mitchell, Morehouse, and Keen, upon the subject of nerve injuries.

In Chapter IV., Dr. Otis takes up the subject of "WOUNDS AND INJURIES OF THE SPINE." The total number of cases to be considered in this chapter is about six hundred, and in his classification of them Dr. Otis adopts his customary division of his subject into three sections.

Incised Wounds, Contusions, and Miscellaneous Injuries.—Only two cases of *incised wound* are recorded, one terminating in recovery and the other proving fatal in the fifth week from exhaustion: a *post-mortem* examination in the latter case revealed a portion of the knife-blade which inflicted the injury, broken off and embedded in the neighbourhood of the fifth dorsal vertebra. *Contusions and miscellaneous injuries* are represented by seventy-nine cases, of which six proved fatal—one from chronic peritonitis, one from smallpox, and four from vertebral fracture or luxation.

Gunshot Wounds.—Cases of gunshot injury of the vertebral column are very frequently complicated with grave lesions of the abdomen, thorax, or great vessels of the neck, and hence, in most cases, prove almost immediately fatal, the number which actually comes under treatment being therefore comparatively limited. Dr. Otis gives in detail the histories of nearly a hundred of the more interesting cases, and then sums up the whole number reported in a tabular statement which we transcribe for our readers' benefit:—

Results of Six Hundred and Forty-two Cases of Gunshot Injuries of the Vertebræ.

REGION.	Cases.	Died.	Discharged.	Duty.	Unknown.	Percentage of mortality.
Cervical	91	63	19	8	1	70.0
Dorsal	137	87	32	18		63.5
Lumbar	149	66	51	28	4	45.5
Cervical and Dorsal .	2	1	1			50.
Dorsal and Lumbar .	3	3				100.
Vertebræ not stated .	260	129	72	50	9	51.4
Aggregate . . .	642	349	175	104	14	55.5

For purpose of comparison with the results exhibited in the above table, we have recast into a similar form the tabular view of the results in 394 cases of spinal injury (derived almost exclusively from the records of civil surgery), taken from the monograph on Injuries of the Spine[1] which was published some years since by the present reviewer:—

Results of Three Hundred and Ninety-four[2] Cases of Spinal Injury.

REGION.	Cases.	Died.	Relieved or not improved.	Recovered.	Unknown.	Percentage of mortality.
Cervical	212	164	8	38	2	77.36
Dorsal	130	82	19	28	1	63.08
Lumbar	57	34	7	15	1	59.66
Not stated	19	5	6	8		26.32
Aggregate[2] . . .	418	285	40	89	4	68.18

In comparing these tables, it must be remembered that the latter includes a certain number of cases which proved instantly or almost immediately fatal, while the former embraces only such cases as survived long enough to have been actually placed under treatment. Some patients, also, who were discharged from service, might and in civil life no doubt would have been considered to have recovered, though not able to endure the hardships of a soldier's life. Making these allowances, it is interesting to observe how closely the results of spinal injuries in civil and in military life correspond with each other, and, more especially, how uniformly the death-rate in both sets of cases varies with the particular part of the vertebral column which is affected.

---

[1] Injuries of the Spine, Philadelphia, 1867, page 43.

[2] In this table, cases in which *two regions* of the spine were involved are noted under *each region.*

The *symptoms* met with in cases of gunshot wound of the spine do not of course materially differ from those noticed in cases of spinal injury from other causes; we observe with interest that *tetanus* is said by Dr. Otis to have occurred as a complication of spine wounds in only seven instances during the war, a circumstance which confirms the opinion which we have elsewhere[1] expressed, that tetanus, if a nervous disease at all, is never primarily one of the central nervous system.

Operations.—Hemorrhage was not a frequent complication in cases of gunshot wound of the spine, during the war, and *arteries were ligated* in only four instances apart from one which has already been referred to in the chapter on Injuries of the Face. In two cases the common carotid artery was tied, in one the left subclavian (presumably for some lesion of the axillary vessels), and in one the occipital. All of the four cases terminated fatally. No instances of formal trephining of the spine were reported, but in 24 cases *fragments of vertebræ were removed*, either primarily, or as exfoliated sequestræ at a later period; ten of these cases terminated fatally, while in nine of those which ended in recovery, the spinous processes alone appear to have been injured. In 34 cases of gunshot injury of the spine *balls were extracted*, and 13 of these cases resulted unfavourably. Dr. Otis's remarks upon the operation of trephining or resection in cases of spinal injury, are very interesting and eminently judicious; he places Louis's famous operation where it properly belongs, among the extractions of loose fragments, and ends by justly declaring that

> "Formal trephining of the spine has hitherto given such unfortunate results, that without much more positive favourable evidence, it cannot be accepted as an established operation."

Chapter V., and the last of the volume before us, deals with the important subject of "WOUNDS AND INJURIES OF THE CHEST," and, like the preceding chapters, embraces three sections, respectively devoted to (1) punctured and incised wounds and miscellaneous injuries—excluding simple fractures, etc., which are considered elsewhere, (2) gunshot wounds of the thorax and its contents, and (3) operations required by the effects of injuries in this region of the body.

Incised Wounds, Contusions, and Miscellaneous Injuries.—Nearly 300 cases are recorded in this section, viz.: nine cases of sabre wound, with one death; 29 of bayonet wound, with nine deaths; 33 of incised and punctured wounds from various weapons, with 12 deaths; and 225 of contusion from railway accidents, falls, kicks from horses, etc., with five deaths.

Gunshot Wounds of the Chest.—This section deals with the records of many thousand cases, and many of the subjects discussed in it are of the highest interest and of the greatest practical importance.

Gunshot flesh wounds of the chest were, of course, very numerous; the results have been ascertained in nearly 11,000 cases, and in only 113 was there a fatal termination—the immediate cause of death in nearly half of these having been, moreover, in no way connected with the injury. Under the head of *non-penetrating injuries of bones* are described cases in which gunshot wounds were complicated with lesions of the osseous or cartilaginous parietes of the chest, without the thoracic cavity itself having been opened, or its contained viscera directly implicated in the injury. Under this head are also given three cases of gunshot fracture of the scapula, in which the cavity of the chest was not primarily opened, but which ultimately proved fatal through the supervention of pleurisy or pneumonia.

---

[1] Op. cit., page 35.

Internal injuries without external wounds were met with in 25 recorded cases, of which 14 terminated in death. These figures probably do not represent the entire number of cases, for, as justly remarked by Dr. Otis:—

> "The severe contusions by large spent shot, causing ruptures of the lung and heart, or laceration and great extravasation, are fatal on the field, and very rarely come under the surgeon's observation, while the slight concussions of the chest cavity often pass unnoticed."

The explanation given by M. Gosselin, of the mechanism of this rare form of injury, is, we believe with Dr. Otis, more satisfactory than any other which has been suggested.

Penetrating gunshot wounds of the chest were observed, during the war, in nearly 9000 cases, of which about five-eighths proved fatal. Several interesting cases of *penetrating and perforating wounds without fracture* are narrated, and Dr. Otis then considers in succession gunshot fractures of the *clavicle*, gunshot fractures of the *scapula*, gunshot penetrating fractures of the *sternum*, gunshot fractures of the *ribs*, *complicated gunshot wounds of the lung*, and gunshot wounds of *both lungs*. With regard to the reported cases of recovery after penetration of both lungs by gunshot missiles, Dr. Otis finds that in no instance is the evidence incontestable; there is no doubt that patients thus injured may survive several (in one instance nine) days, but that recovery ever follows under these circumstances is yet open to doubt.

Seventeen pages are devoted to a consideration of Dr. Benjamin Howard's famous plan of "*hermetically sealing*" gunshot wounds of the chest, and all the evidence on the subject that has been obtained by the Surgeon-General's office, is here fully set forth, Dr. Otis rightly considering that it is—

> "Not a work of supererogation or an unnecessary occupation of space to show conclusively that what has been bruited abroad as the *American plan* of treating gunshot penetrating wounds of the chest, was fairly tested during the war, and its indiscriminate application found to be pernicious."

We have not space to follow Dr. Otis in his demonstration of the true merits—or rather want of merit—of Dr. Howard's much vaunted mode of treatment, but shall merely say that while 42 patients, whose wounds were "hermetically sealed," perished, only 27 survived, and in only 20 of these was it specified that the lung was wounded. To be sure, as remarked by Dr. Otis, this rate of mortality (60.8 per cent.) would not seem excessive if the successful cases were all actually instances of penetrating chest wound.

> "But," adds Dr. Otis, "we fear that the statistical statement is open to many criticisms. Undoubtedly there are on the pension rolls the names of thirteen patients who recovered from alleged penetrating gunshot wounds of the chest under the treatment by hermetically sealing, and have survived their injuries from seven to nine years. Only one . . . enjoys good health . . . Two of the twelve other pensioners have necrosis and empyema, and interminably open sinuses; five suffer from hæmoptysis; two have partial paralysis;

the others suffer from chronic cough, solidification of portions of the lung, dyspnœa, and other evidences of damage to the respiratory apparatus . . . With all these disabilities they still live. Of five cases, reported as rapid recoveries (from lung wounds in each instance), there are no late histories . . . There remain, of the twenty-seven reported recoveries, nine cases, two of which . . . appear to be satisfactory, while seven are open to objection. . . . It is almost incredible that Dr. M. . . . should have sent Larkin to the ranks, knowing that he had been shot through the left lung one month before, no matter how complete his convalescence might appear; yet such is the record. Captain P. . . . was discharged, and may have had the unusual generosity to waive his claim for pension; but it is so extraordinary that the six enlisted men reported to have been shot through the chest should all have failed to make application for pension, that it is difficult to avoid the conviction that either the gravity of the injuries sustained by these men was, happily, greatly exaggerated originally, or else that the men imprudently returned to duty, were killed in action, or died in captivity. In the writer's judgment, only three of the series of twenty-seven cases . . . are authenticated as complete and permanent recoveries. . . . There is reason to believe that those signs which, when several coexist, afford a strong presumption of lesion of the lung, were wanting in many of the cases, and that the diagnoses given were unwarranted. There is no doubt that, in some of the cases, threatened asphyxia from hæmothorax or empyema made it impracticable to persevere in the occlusive treatment, and that the wounds were open during convalescence. The fatality of gunshot wounds really penetrating or perforating the lung is so great, that science would have been immeasurably indebted to Dr. Howard for an improvement upon ordinary methods of dealing with these serious injuries. It is obvious that such a pretension is far from having been established; it is probable that the routine application of the plan has not been unattended by disastrous results; and it is to be lamented that the numerous experiments have not even advanced our pathological knowledge."

Hernia of the lung was observed in seven cases during the war, and in three instances is believed to have ended fatally; ligation of the protruded pulmonary tissue was resorted to in two of the successful, and in one of the unsuccessful cases.

No complication of gunshot wounds of the chest is more common, nor is any more to be dreaded, than *hemorrhage*, and, accordingly, Dr. Otis's remarks upon this subject will be read with great interest by all practical surgeons. No examples were recorded during the war of gunshot wound of the *thoracic aorta*, and if any such occurred, the patients did not survive long enough to be placed under treatment. Since the war, however, Dr. Piper has reported a case of accidental pistol-shot perforation of the aortic arch, and Dr. Lidell has recorded a case of pistol-shot wound of the aorta just beyond the semilunar valves. Dr. White has also recorded a case of bayonet wound of the thoracic aorta, which proved quickly fatal from hemorrhage. Wounds of the *descending vena cava* were observed in a few instances, and two cases have been reported since the war, one the result of gunshot injury, and the other a case of arrow wound; in the latter case the victim, though scalped and otherwise injured, survived forty hours. Wounds of the *innominate* and *subclavian arteries* were observed in several cases:—

"It is quite time," says Dr. Otis, "that the dictum of Jourdan that surgery is powerless in lesions of arteries within the cranial, thoracic, and abdominal cavities should be expunged from the text-books. At least five cases occurred during the late war, of wounds of the subclavian in which surgical intervention was justifiable, and in one of these, the left subclavian was successfully tied by a Confederate surgeon, for a wound of the vessel where it passes across the first rib."

A few examples are recorded of wounds of the *internal mammary* and *intercostal arteries;* there was but one case (and that of doubtful authenticity) of *gunshot wound of the subclavian vein*, but there are specimens in the army medical museum of *rupture* and of *bayonet wound* of that vessel. *Traumatic aneurism* was but rarely met with as a sequence of gunshot wounds of the large vessels of the thorax.

Wounds of the pericardium and heart were observed in a number of cases, some of which proved instantly fatal, while in others the patients survived for a considerable period; among the reported cases of wounded pericardium, there were indeed several recoveries, but in these the diagnosis necessarily lacked the confirmation of an autopsy. This section is terminated with brief remarks upon *cardiac diseases resulting from wounds*, gunshot wounds of the *mediastinum*, wounds of the *thoracic duct*, wounds of the œsophagus, wounds of the intrathoracic *nerves*, and wounds of the *diaphragm*.

Operations on the Chest.—In this section are considered ligations of the arteries of the chest, excisions of portions of the bony parietes, extractions of splinters, missiles, etc., and instances of thoracentesis.

No case of *ligation of the innominate* occurred during the war, though this vessel was wounded in several instances. Dr. Otis suggests, on theoretical but we think perfectly tenable grounds, that the proper treatment for a wound of the distal portion of the brachio-cephalic trunk would be to tie this vessel itself in its middle portion, tying also the carotid and subclavian arteries, as near their points of origin as possible, and then to amputate at the shoulder.

Ligation of the subclavian was performed in 25 cases, 20 of which proved fatal; in two instances the vessel was secured in its *first* portion, and in two in its *second* portion, or between the scaleni muscles. In 16 cases the operation was performed for hemorrhage, and in nine cases for traumatic aneurism of the axillary artery. The *right* subclavian was tied in 13, and the *left* in 12 cases. One instance of subclavian ligation was recorded in the chapter on wounds of the neck, and 26 more will be given in a future volume in considering wounds of the upper extremity, so that the total number of cases reported during the war is 52, of which 41 (78.8 per cent.) terminated fatally.

The *internal mammary artery* was tied twice without success; the *suprascapular* artery once, with success; and the *intercostal* artery eight times, with two successes and six failures. Thirteen cases of ligation of the *axillary artery* (all fatal) are also recorded, and reference is made to other cases which will be detailed when Dr. Otis comes to speak of wounds of the arm.

Excision of the clavicle was performed in eleven cases, *complete* excision having been resorted to twice (with a fatal result), and *partial* excision nine times, with five deaths and four recoveries. Partial excision of the *scapula* appears to have been performed four times with but one death, and partial excision of one or more *ribs* in thirteen cases with four deaths. Operations on the *sternum* appear to have been limited to the removal of fragments, or of sequestra separated by exfoliation. The death-rate of gunshot fracture of the sternum seems not to be very high, for of fifty-one recorded cases, but eighteen (35.3 per cent.) terminated fatally.

Thoracentesis was performed in 28 cases with nine recoveries, or, deducting eight cases of effusion from idiopathic pleurisy, in 20 cases with only four recoveries, this large death-rate (80 per cent.) indicating that the mortality of penetrating gunshot wounds of the chest is not materially affected by the operation. *Drainage tubes* were employed in some cases of empyema, and in others free *incisions* were made into the pleural cavity, while in some instances the evacuation of foreign bodies, etc., was facilitated by the use of mild detergent *injections*.

Balls or other foreign substances were extracted from the chest in 316 cases, of which 108 proved fatal. In 41 cases the projectile was lodged beneath the soft parts, without having injured the contents of the chest; of the remaining 275 cases, 108 terminated in death, while the result in nine is unknown—159, or more than half of the whole number, being reported as instances of recovery.

> "As the names of the majority are found on the pension roll, there can be little doubt of the fact of recovery; but there is every reason to believe that the gravity of the injury was overestimated, and that many cases returned as penetrating wounds of the chest, in reality were wounds of the parietes only."

The last portion of the volume before us (but by no means the least in interest and importance) is devoted to a consideration of the *Mortality, Complications, Diagnosis*, and *Treatment* of wounds of the chest. The limited space remaining at our disposal compels us to hurry over this part of the book more rapidly than either its merits or our own inclination would direct, and we must content ourselves with referring to some of the more salient points which attract our attention as we turn over the pages.

Comparing the statistics of chest wounds derived from the records of our war with those derived from the records of various European wars before and since, Dr. Otis finds that it may be estimated with close approximation to accuracy, "that of those killed in battle, from one-third to one-half, and of those wounded in action, one-twelfth, receive wounds of the chest." The *mortality* of penetrating gunshot wounds of the chest, Dr. Otis finds to have been in the Union army, 62.4 per cent., which, as shown by a table on page 608, is slightly less than the average obtained by combining the statistics of various foreign wars. These figures show clearly of how grave a character these injuries really are, and it is probable that if those cases only were considered, in which the lung itself is known to have been wounded, the death-rate would be found to be still higher.

Emphysema seems to be a less frequent complication of penetrating chest wounds than it was formerly thought to be; at least it was noted in only 38 of nearly 9000 cases recorded in this chapter. *Traumatic pleurisy*, though regarded by Mr. Erichsen, and other systematic writers, as a necessary result of penetrating wounds of the chest, is found in practice to be really a somewhat infrequent complication; so *traumatic pneumonia*, though said by the English writer quoted, to be "an invariable sequence" of lung wound, and to have "frequently a tendency to extend to some distance around the part injured," is, in point of fact, comparatively seldom met with. Indeed there can be no doubt that Dr. Otis is quite right in declaring that—

> "It is certain that pneumonia, in the ordinary acceptation of the term, is *not* an invariable sequence of wounds of the lung. It is probable that it is not a frequent sequence."

The fact is that *pneumonia* (as met with in idiopathic cases) is something more than mere *pulmonary inflammation;* and though pathologists who hold, as we do, that all repair after injury is effected by means of inflammatory changes, must consistently believe that lung wounds are followed by *inflammation in the track of the wound*, yet it is quite certain that *pneumonia* (as the term is used by physicians) is, upon the whole, rather an unusual complication of lung injuries, and it is probable that its occurrence, when met with, is more owing to the constitutional condition of the patient, at the time of or subsequent to the reception of the wound, than to the wound itself.

Pneumothorax, *hydrothorax*, and *hæmothorax* are each made the subject of interesting remarks, by Dr. Otis, who shows, from an examination of all the evidence on the subject, that *lumbar ecchymosis*, contrary to the doctrine of Valentin and Larrey, is really of very little value as a diagnostic sign of the presence of blood in the cavity of the pleura. *Abscesses of the lung*, due to the presence of foreign bodies, were often observed in the recorded cases of chest wound, and, more rarely, the so-called "metastatic abscesses" of pyæmia. *Thoracic fistulæ* were observed in some cases, as were *secondary emphysema* and *pneumothorax*; *erysipelas*, *gangrene*, and *tetanus* were very rarely met with as complications of chest wounds.

As regards the *diagnosis* of wounds of the lung, Dr. Otis's investigations fully confirm the opinion advanced by Fraser and others, that none of the symptoms formerly regarded as characteristic of these injuries can be considered pathognomonic, though, when several are observed in combination, they furnish strong presumptive evidence that the lung has been wounded.

The *treatment* of gunshot wounds of the chest in vogue among military surgeons, has undergone a complete revolution within a comparatively recent period: it is indeed only since 1855, when Dr. Fraser published his admirable monograph, that it has really been questioned whether the profuse bleedings recommended by the older surgeons were absolutely necessary or even desirable. The evidence adduced by Dr. Otis from the records of our late war, would seem to settle this point definitively; it may now indeed—

> "Be regarded as generally admitted that venesection is unnecessary in penetrating wounds of the chest, and that it may be very harmful, and that the 'draining of the system of blood,' commended by Bell, Hennen, Guthrie, and Cooper, is to be numbered with the errors of the past."

We have thus come to the end of Dr. Otis's magnificent volume, some idea of the value of which we have striven to give our readers, however inadequately, by means of analysis and extract. The work, as we said in the beginning of this review, scarcely admits of criticism, but no critic can hesitate to declare that in every respect it reflects the highest credit upon all concerned in its production, from the Surgeon General, under whose general supervision it has been prepared, down to the printer and engraver, who are directly responsible for its mechanical execution. The book is very handsomely, and, considering the immense amount of matter which it contains, upon the whole very correctly printed; it is elegantly illustrated with thirteen highly finished chromo-lithographic plates, and over three hundred well-executed wood-cuts. There is one deficiency in this volume, which we hope to see supplied when the whole history is completed; we allude to the want of an index. The arrangement of the work is such that the information furnished upon any one subject (as, for instance, deligation of the common carotid artery) is necessarily scattered in different parts of the book, and, with merely the brief table of contents for a guide, it is often almost impossible for the student to find what he is in search of.

We sincerely trust that a most elaborate and carefully constructed index will yet be furnished; for, if it is not, the rich store of knowledge which Dr. Otis has with so much zeal and labour accumulated, will, we fear, be for most readers but buried treasure. J. A., JR.

ART. XVIII.—*The Physiology of Man; designed to represent the existing State of Physiological Science, as applied to the Functions of the Human Body.* Vol. IV. *The Nervous System.* By AUSTIN FLINT, Jr., M.D., Professor of Physiology and Physiological Anatomy in the Bellevue Hospital Medical College, New York, etc. 8vo. pp. 470. New York: D. Appleton & Co., 1872.

OUR readers will remember that three volumes of Prof. Flint's "Physiology" have already appeared, and have been critically examined in the pages of this Journal. These volumes were occupied with an account of the blood, circulation, respiration, alimentation, digestion, absorption, the lymph and chyle, secretion, excretion, the ductless glands, nutrition, animal heat, movements, voice and speech. The present volume, constituting the fourth of the series, is devoted entirely to the consideration of the Nervous System.

The whole of the first chapter is taken up with a description of the structure and chemical composition of the nerves, their branching, course, and mode of termination, and their capability of being regenerated after section or even excision of a portion of their substance. In describing the minute anatomy of nerves, Prof. Flint divides them into the simple or non-medullated, the medullated and gelatinous, following, for the most part, in his histological account, the well known observations of Robin, Kölliker, Fromman, Grandry, Schultze, Remak, and other eminent authorities in this special field of research.

The motor and sensory properties of the roots of spinal nerves, the influence exerted upon the nutrition of the posterior roots by their ganglia, the mode of action of both motor and sensory nerves, and the subject of recurrent sensibility are briefly discussed in this chapter. In this connection Dr. Flint devotes a considerable space—one-half, indeed, of the whole chapter—to a critical review of the claims of Walker, Mayo, Bell, and Magendie, as to the priority of discovery of the distinct seat of motion and sensation in the roots of spinal nerves. In a work designed to represent the existing state of physiological science, and issued as a text-book upon this science for the medical student, it was scarcely necessary to discuss this subject in such lengthened detail, especially as it had already been, as the author himself observes, correctly reviewed in the *London Medical and Physical Journal*, in 1829, by Elliotson in his *Human Physiology* in 1840, by Velpeau in 1866, and Bernard in 1867.

Chapter III. is devoted to the consideration of nervous irritability, the nature of the so-called nerve-force, and the phenomena produced by the application of electricity to the nerves. The well-known observations and experiments of Bernard and Longet upon the excitability of nerves, and the phenomena of the progressive disappearance of their irritability after excision; those of Prévost and Dumas, and of Matteucci and Longet show-